LaMET 2021 Online

Report of Contributions

Contribution ID: **1**   Type: **not specified**

Distribution amplitudes of K* and φ from lattice QCD with large momentum effective theory

Wednesday, 8 December 2021 08:55 (20 minutes)

We present the first lattice QCD calculation of the distribution amplitudes of longitudinally and transversely polarized vector mesons K∗ and φ using large momentum effective theory. We use the clover fermion action on three ensembles with 2+1+1 flavors of highly improved staggered quarks (HISQ) action, generated by MILC collaboration, at physical pion mass and {0.06, 0.09, 0.12} fm lattice spacings, and choose three different hadron momenta P_z = {1.29,1.72,2.15} GeV. The resulting lattice matrix elements are nonperturbatively renormalized in a hybrid scheme proposed recently. An extrapolation to the continuum and infinite momentum limit is carried out. We find that while the longitudinal distribution amplitudes tend to be close to the asymptotic form, the transverse ones deviate rather significantly from the asymptotic form. Our final results provide crucial ab initio theory inputs for analyzing pertinent exclusive processes.

Primary authors: HUA, Jun; WANG, Wei (SJTU); YANG, yibo (I)

Presenter: HUA, Jun

Session Classification: Session I

Contribution ID: **2**   Type: **not specified**

Light-Front Wave Functions From LaMET

Thursday, 9 December 2021 08:30 (25 minutes)

Light-front wave functions play a fundamental role in the light-front quantization approach to QCD and hadron structure. However, a naive implementation of the light-front quantization suffers from various subtleties including the well-known zero-mode problem such as the associated rapidity divergences as well as breaking of spatial rotational symmetry. In the talk, I will show that the light-front quantization should be viewed as an effective theory in which small k^+ modes have been effectively "integrated out", with an infinite number of renormalization constants. Instead of solving light-front quantized field theories directly, we make the large momentum expansion of the equal-time Euclidean correlation functions in instant quantization as an effective way to systematically calculate light-front correlations, including the light-front wave function amplitudes. This large-momentum effective theory accomplishes an effective light-front quantization through lattice QCD calculations. We demonstrate our approach using an example of a pseudo-scalar meson wave function.

Primary author: LIU, Yizhuang (Jagiellonian University)

Presenter: LIU, Yizhuang (Jagiellonian University)

Session Classification: Session I

Contribution ID: **3**   Type: **not specified**

Topics in LaMET

Tuesday, 7 December 2021 09:35 (20 minutes)

I would like to talk about some unrelated topics in LaMET, including the renormalon effect, applying Chiral Perturbation Theory to quasi-PDFs, and the matching kernels for the hybrid renormalization and self-renormalization.

Primary author: CHEN, Jiunn-Wei

Presenter: CHEN, Jiunn-Wei

Session Classification: Session I

Contribution ID: **4**   Type: **not specified**

Disentangling Long and Short Distances in Momentum-Space TMDs

Thursday, 9 December 2021 10:35 (20 minutes)

The extraction of nonperturbative TMD physics is made challenging by prescriptions that shield the Landau pole, which entangle long- and short-distance contributions in momentum space. The use of different prescriptions then makes the comparison of fit results for underlying nonperturbative contributions meaningless on their own. We propose a model-independent method to restrict momentum-space observables to the perturbative domain. This method is based on a set of integral functionals that act linearly on terms in the conventional position-space operator product expansion (OPE). Artifacts from the truncation of the integral can be systematically pushed to higher powers in $\Lambda_{\mathrm{QCD}}/k_T$. We demonstrate that this method can be used to compute the cumulative integral of TMDPDFs over k_T in terms of collinear PDFs, accounting for both radiative corrections and evolution effects. This gives a systematic way of correcting the naive picture where the TMDPDF integrates to a collinear PDF, and we find that for the unpolarized distribution the corrections are a percent-level effect. We also show that, when supplemented with experimental data and improved perturbative inputs, these functionals will enable model-independent limits to be put on the nonperturbative OPE contributions in the Collins-Soper kernel and intrinsic TMD distributions.

Primary authors: STEWART, Iain (MIT); SUN, Zhiquan; MICHEL, Johannes (MIT CTP); EBERT, Markus (MIT)

Presenter: SUN, Zhiquan

Session Classification: Session II

Contribution ID: **5**   Type: **not specified**

Collins-Soper kernel from transverse momentum-dependent wave functions in LaMET

Thursday, 9 December 2021 08:55 (20 minutes)

In this work we present the transversity $b_\perp$-dependence Collins-Soper kernel extracted from pion transverse momentum dependent wave functions in the framework of large momentum effective theory from lattice QCD. We use clover fermion action with $2 + 1 + 1$ flavors of highly improved staggered quarks (HISQ), generated by MILC Collaboration. A single ensemble is used, with lattice spacing $a = 0.12$fm and volume as $L^3 \times T = 48^3 \times 64$. The results are presented based on pion mass $M_\pi = 670$MeV, and three hadron momenta as $P^z = 2\pi/L \times \{8, 10, 12\} = \{1.72, 2.15, 2.58\}$GeV. The result of Collins-Soper kernel is determined of joint fit through momentum pairs.

Primary authors: CHU, Min-Huan (Shanghai Jiao Tong University); WANG, Wei (SJTU)

Presenter: CHU, Min-Huan (Shanghai Jiao Tong University)

Session Classification: Session I

Contribution ID: **6**   Type: **not specified**

Updated Result on Nucleon Transversity Parton Distribution Function from Lattice QCD

Wednesday, 8 December 2021 09:40 (25 minutes)

In this talk, I present some updated results on nucleon transversity parton distribution function (PDF) from lattice QCD using large-momentum effective theory. The calculation is done with three lattice spacings, 0.086, 0.064 and 0.049 fm. The bare matrix elements are nonperturbatively renormalized in a recently proposed hybrid scheme. Also a continuum extrapolation is performed. Our results show agreement with recent global analyses within errors.

Primary author: YAO, Fei

Presenter: YAO, Fei

Session Classification: Session I

Contribution ID: **7**   Type: **not specified**

Pion and kaon distribution amplitudes and SU(3) flavor breaking effect from lattice QCD

Wednesday, 8 December 2021 08:30 (25 minutes)

We present the state-of-the-art lattice QCD calculation of the light-cone distribution amplitudes (DAs) of pion and kaon using large-momentum effective theory. The calculation is done at three lattice spacings $a \approx \{0.06, 0.09, 0.12\}$˜fm and physical pion and kaon masses, with the meson momenta $P_z = \{1.29, 1.72, 2.15\}$ GeV. The result is non-perturbatively renormalized in a recently proposed hybrid scheme, and extrapolated to the continuum as well as the infinite momentum limit. We find {a significant deviation of the pion and kaon DAs from the asymptotic form, and make a prediction for the $SU(3)$ flavor breaking effect in the kaon DA.

Primary authors: HUA, Jun (Shanghai Jiao Tong University); HE, Jinchen; WANG, Wei (SJTU); YANG, yibo (I)

Presenter: HE, Jinchen

Session Classification: Session I

Contribution ID: **8**   Type: **not specified**

One-loop structure of parton distribution for the gluon condensate and "zero modes"

Wednesday, 8 December 2021 11:40 (20 minutes)

We present the results for the one-loop corrections to the "gluon condensate" twist-4 PDF F(x), in particular, we give expression for the gg-part of its evolution kernel. To enforce strict compliance with the gauge invariance requirements, we have used on-shell states for external gluons and have obtained identical results both in Feynman and light-cone gauges. No "zero mode" terms were found for $F(x)$. However, a $q^2\delta(x)$ term was found for the $\xi = 0$ GPD $F(x, q^2)$ at nonzero momentum transfer q. These results do not agree with the original attempt of one-loop calculations of $F(x)$ for gluon states, which sets alarm warning for calculations and the lattice renormalization procedures that use matrix elements with virtual external gluons.

Primary authors: RADYUSHKIN, Anatoly; ZHAO, Shuai (Old Dominion University/Jefferson Lab)

Presenter: ZHAO, Shuai (Old Dominion University/Jefferson Lab)

Session Classification: Session II

Contribution ID: **9**   Type: **not specified**

The continuum and leading twist limits of pseudo-PDFs

Tuesday, 7 December 2021 10:25 (25 minutes)

The continuum limit is a fundamental step when using a lattice regulator and necessary for any high precision calculation using lattice QCD. The matrix elements used in determining a PDF have two dimensionful parameters, compared to the 0 or 1 of most lattice calculations, which significantly complicates the continuum limit extrapolation. In this presentation, I will describe a method which will allow for a continuum limit extrapolation from any ensemble without having to fix any of the parameters. It also can be extended to other systematic errors such as removing higher twist effects. I will demonstrate this method on a set of ensembles with $m_\pi = 440$ MeV and lattice spacings $a = 0.048, 0.065,$ and 0.075 fm.

Primary authors: RADYUSHKIN, Anatoly; KARPIE, Joseph; ORGINOS, Kostas (William and Mary - Jlab); ZAFEIROPOULOS, Savvas (Aix Marseille Univ. & CNRS)

Presenter: KARPIE, Joseph

Session Classification: Session II

Contribution ID: **10**   Type: **not specified**

Gluon Parton Distribution of the Pion and Nucleon from Lattice QCD

Wednesday, 8 December 2021 10:55 (20 minutes)

We present the x-dependent nucleon and pion gluon distribution from lattice QCD using the pseudo-PDF approach, on lattice ensembles with $2 + 1 + 1$ flavors of highly improved staggered quarks (HISQ), generated by MILC Collaboration. We use clover fermions for the valence action and momentum smearing to achieve pion boost momentum up to 2.56˜GeV on three lattice spacings $a \approx 0.9, 0.12$ and 0.15˜fm and three pion masses $M_\pi \approx 220, 310$ and 690˜MeV.
We compare our pion and preliminary nucleon gluon results with the determination by global fits.

Primary authors: LIN, Huey-Wen; FAN, Zhouyou

Presenter: FAN, Zhouyou

Session Classification: Session II

Contribution ID: **11**

Type: **not specified**

Approaching Continuum limits of Strange Parton Distribution Functions in Lattice QCD

We present preliminary lattice QCD calculations of the unpolarized and polarized distributions of the strange quark using the LaMET method. We use three $N_f = 2 + 1 + 1$ HISQ ensembles generated by MILC collaboration at lattice spacings $a \approx 0.09, 0.12$ and 0.15 fm, and clover valence fermions with two valence pion masses: 310 and 690 MeV. We use momentum-smeared sources to improve the signal up to nucleon boost momentum $P_z = 2.15$ GeV, and determine nonperturbative renormalization factors in RI/MOM scheme. We compare our results with the matrix elements obtained from matching the PDFs from CT18NNLO and NNPDF3.1NNLO global fits.

Primary authors: MONDAL, Santanu (Michigan State University); LIN, Huey-Wen (Michigan State University); YOON, Boram (Los Alamos National Laboratory)

Presenter: MONDAL, Santanu (Michigan State University)

Session Classification: Session II

Contribution ID: **12**   Type: **not specified**

Polarized gluon pseudodistributions at short distances

Wednesday, 8 December 2021 10:35 (20 minutes)

We present the results that are necessary in the ongoing lattice calculations of the polarized gluon parton distribution functions within the pseudo-PDF approach. We give a classification of possible two-gluon correlator functions and identify those that contain the invariant amplitude determining the polarized gluon PDF in the light-cone $z^2 \to 0$ limit. One-loop calculations have been performed in the coordinate representation and in an explicitly gauge-invariant form. We introduce the reduced Ioffe-time distribution (ITD), which requires a special construction in this case, and obtain the matching relation between the reduced ITD and its light-cone analog that is necessary for conversion of lattice data into the light-cone PDF.

Primary authors: RADYUSHKIN, Anatoly; BALITSKY, Ian (JLab/ODU); MORRIS, Wayne

Presenter: MORRIS, Wayne

Session Classification: Session II

Contribution ID: **13**   Type: **not specified**

Review on Linear Divergence

Tuesday, 7 December 2021 09:15 (20 minutes)

Large-momentum effective theory provides a way to extract the parton physics from lattice data based on first-principle calculation. In applying large-momentum effective theory, renormalization of
the Euclidean correlators in lattice regularization is a challenge due to
linear divergences in the self-energy of Wilson lines. We will give a review on different renormalization methods to deal with linear divergences, including RI/MOM and ratio scheme. In these renormalization methods, people divide the bare hadron matrix element by another matrix element. Then we will talk about the self-renormalization method proposed recently, including a detailed numerical test on the linear divergence factors in the previous methods. Our test shows that the linear divergence can be eliminated in the ratio scheme. Moreover, we find a large non-perturbative effect in the RI/MOM and
ratio scheme, suggesting favor of the hybrid renormalization procedure proposed recently. Finally, we will talk about the hybrid renormalization method.

Primary author: SU, Yushan (University of Maryland)

Presenter: SU, Yushan (University of Maryland)

Session Classification: Session I

Contribution ID: **14**   Type: **not specified**

Renormalize quasi TMD-PDF on lattice

Thursday, 9 December 2021 09:40 (25 minutes)

Non-local operator has linear divergence on lattice. RI/MOM scheme cannot eliminate the linear divergence in quasi-PDF operator, especially for the clover valence quark. Using RI/MOM scheme will undermine the credibility of our results.

We try to use the square root of Wilson loop to renormalize bare matrix element of TMD-PDF. When calculating TMD-PDF in the rest frame, we found renormalized matrix elements on different lattice spacings are separated, especially for the finer lattice. But if we change the scale from fm to a(lattice spacing), the curves of different lattice spacings are consistent, which indicates that the linear divergence has been eliminated and only the $\log(z/a)$ and $\log(b/a)$ are left. In fact, perturbation theory tells us that Wilson loop is not able to cancel out all the log divergences, even in the one-loop level.

We are trying to remove those log divergences and renormalize quasi TMD-PDF.

Co-author: YANG, Yi-Bo (CAS)

Presenter: ZHANG, Kuan (Institute of Theoretical Physics, Chinese Academy of Sciences)

Session Classification: Session I

Contribution ID: **15**   Type: **not specified**

The transversity parton distribution function of the nucleon using the pseudo-distribution approach

Wednesday, 8 December 2021 09:15 (25 minutes)

I will present some recent results from the HadStruc collaboration on the extraction of transversity PDF of the proton by using fits to NLO leading-twist OPE. I will explain how the systematic errors are taken care of, and then present the x-dependence of the transversity PDF and its comparison with recent JAM global fit results.

Primary authors: HADSTRUC COLLABORATION; KARTHIK, Nikhil

Presenter: KARTHIK, Nikhil

Session Classification: Session I

Contribution ID: **16**   Type: **not specified**

Gluon distributions of the nucleon from lattice QCD

Wednesday, 8 December 2021 11:15 (25 minutes)

We present lattice QCD calculation of unpolarized and polarized gluon Ioffe-time distributions using the pseudo-PDFs approach. We construct the nucleon interpolation fields using the distillation technique and smear the gauge fields using gradient flow. We calculate flow time-independent reduced Ioffe-time pseudo-distribution and from that, determine the unpolarized gluon PDF in the $\overline{\mathrm{MS}}$ scheme at $\mu = 2$ GeV. We also present progress towards determining gluon helicity distribution from lattice QCD calculation.

Primary author: SUFIAN, Raza

Presenter: SUFIAN, Raza

Session Classification: Session II

Contribution ID: **17**   Type: **not specified**

Valence parton distribution of pion from lattice QCD at physical point

Tuesday, 7 December 2021 08:55 (20 minutes)

We present the first lattice calculation of pion valence parton distribution using matching formula at NNLO level. We use the Wilson-Clover fermion on three 2+1 flavor HISQ ensembles of lattice spacings a = 0.04, 0.06 and 0.076 fm, with two pion mass including the physical one. Two unitary Domain-Wall calculations at physical point are also presented. This allows us to control the continuum limit, quark mass effects as well as the chiral symmetry. Our analysis use ratio-based schemes to renormalize the equal-time bilocal quark-bilinear matrix elements. We extract first few moments model independently and reconstruct the x-dependent PDF.

Primary authors: HANLON, Andrew (Brookhaven National Laboratory); JIN, Luchang; PETRECZKY, Peter (BNL); MUKHERJEE, Swagato (Brookhaven National Laboratory); GAO, Xiang (BNL&CCNU); KARTHIK, Nikhil; SCIOR, Philipp (BNL); SYRITSYN, Sergey (Stony Brook University); ZHAO, Yong (Brookhaven National Laboratory)

Presenter: GAO, Xiang (BNL&CCNU)

Session Classification: Session I

Contribution ID: **18**   Type: **not specified**

Towards High-Precision Nucleon Parton Distributions via Distillation

Tuesday, 7 December 2021 10:50 (25 minutes)

We apply the Distillation spatial smearing program to the extraction of the
unpolarized isovector valence PDF of the nucleon using the pseudo-distribution formalism. The
improved volume sampling and control of excited-states afforded by distillation leads to a dramatically improved determination of the requisite Ioffe-time Pseudo-distribution (pITD).
The valence PDF is extracted by analyzing both the matched Ioffe-time Distribution (ITD), as well
as a direct matching of the pITD to the PDF. The latter method of extraction is facilitated by a
novel expansion of the pITD in a set of Jacobi polynomials using the NLO coordinate space matching kernel. Generalizing this expansion, we are able to introduce nuisance parameters to quantify
and remove higher-twist and discretization effects present in the pITD signal - the most notable
among these being a short-distance tension of the pITD with the expected DGLAP evolution of the
unpolarized pseudo-PDF. Observance and correction of this discrepancy underscores the utility of
distillation in such structure studies. Prospects for other collinear distributions is also discussed.

Primary authors: EGERER, Colin (Jefferson Lab); EDWARDS, Robert; KALLIDONIS, Christos
(Thomas Jefferson National Accelerator Facility); ORGINOS, Kostas (William and Mary - Jlab); RADYUSHKIN,
Anatoly; RICHARDS, David (Jefferson Lab); ROMERO, Eloy (Jefferson Lab); ZAFEIROPOULOS, Savvas
(Aix Marseille Univ. & CNRS)

Presenter: EGERER, Colin (Jefferson Lab)

Session Classification: Session II

Contribution ID: **19**

Type: **not specified**

Lattice QCD Determination of the Bjorken-x Dependence of PDFs at Next-to-next-to-leading Order

Tuesday, 7 December 2021 08:30 (25 minutes)

In this talk, we present a direct calculation of the x-dependence of pion valence PDF with the large-momentum effective theory approach. In this calculation we adopt the most up-to-date theoretical developments on the systematic corrections, which include the hybrid renormalization scheme that rigorously renormalizes the lattice matrix elements at both short and long distances, as well as the two-loop matching kernel that allows for direct calculation of the x-dependence of the PDF without any model assumption. Therefore, we are able to make predictions for the PDF at $x \in [x_{\min}, x_{\max}]$ where the systematic uncertainties are under control, which is a firm step towards precision-controlled calculation.

Primary authors: Dr GAO, Xiang (Brookhaven National Laboratory); HANLON, Andrew (Brookhaven National Laboratory); KARTHIK, Nikhil (Thomas Jefferson National Accelerator Facility); MUKHER-JEE, Swagato (Brookhaven National Laboratory); PETRECZKY, Peter (BNL); SCIOR, Philipp (BNL); SYRIT-SYN, Sergey (Stony Brook University); ZHAO, Yong

Presenter: ZHAO, Yong

Session Classification: Session I

Contribution ID: **20**   Type: **not specified**

First Lattice QCD Study of Proton Twist-3 GPDs

Thursday, 9 December 2021 11:20 (20 minutes)

Calculating the x-dependence of PDFs and GPDs from lattice QCD has become feasible in the last few years due to novel approaches. In the work presented, we employ the quasi-distributions method, which relies on matrix elements of non-local operators, matched to the light-cone distributions using Large Momentum Effective Theory (LaMET). We focus on results for the first-ever lattice QCD calculation of twist-3 GPDs. The calculation is performed using one ensemble of two degenerate light, a strange and a charm quark (Nf =2+1+1) of maximally twisted mass fermions with a clover term leading to a pion mass of 260 MeV.

Primary authors: METZ, Andreas (Temple University); DODSON, Jack; SCAPELLATO, Aurora (Temple University); Dr STEFFENS , Fernanda (University of Bonn); Dr CICHY, Krzystof (Adam Mickiewicz University); CONSTANTINOU, Martha (Temple University); BHATTACHARYA, Shohini (Temple University)

Presenter: DODSON, Jack

Session Classification: Session II

Contribution ID: **21**   Type: **not specified**

x-dependence of transversity GPDs on the lattice

Thursday, 9 December 2021 10:55 (25 minutes)

In this talk we present results for isovector transversity generalized parton distributions (GPDs) of the proton obtained within lattice QCD. We employ the quasi-distribution formalism, which relies on computations of nonlocal matrix elements of boosted hadron states. Large momentum effective theory (LaMET) is then used to match quasi- to light-cone GPDs.

Results are obtained on an $N_f = 2 + 1 + 1$ ensemble of maximally twisted mass fermions, with pion mass $M_\pi = 260$ MeV and lattice spacing $a \simeq 0.093$ fm. The proton is boosted up to 1.67 GeV. Using this setup we disentangle the four transversity GPDs that exist for the proton (H_T, E_T, $\tilde{H}_T$, $\tilde{E}_T$) and extract the x-dependence of the GPDs at zero and nonzero skewness.

Primary authors: SCAPELLATO, Aurora; ALEXANDROU, Constantia; STEFFENS, Fernanda (University of Bonn); JANSEN, Karl (DESY); CICHY, Krzystof (Adam Mickiewicz University); HADJIYIAN-NAKOU, Kyriakos (The Cyprus Institute); CONSTANTINOU, Martha (Temple University)

Presenter: SCAPELLATO, Aurora

Session Classification: Session II

Contribution ID: **22**   Type: **not specified**

Global QCD Analysis of Pion Parton Distributions Including Lattice QCD Data

Tuesday, 7 December 2021 11:45 (20 minutes)

For the first time, we perform a fit of pion parton distribution functions (PDFs) to reduced pseudo Ioffe time distributions and current-current correlator "good lattice cross sections" generated from lattice QCD simultaneously with experimental data. We make use of the factorization formulas convoluting the matching coefficients with the valence quark distribution to fit to real components of the lattice QCD data. We discuss the impacts of each of the lattice QCD datasets on the central values and uncertainties of the various JAM PDF sets, as well as quantify the systematic effects associated with the lattice.

Primary authors: MONAHAN, Chris (William & Mary); EGERER, Colin (Jefferson Lab); BARRY, Patrick; RICHARDS, David (Jefferson Lab); QIU, Jianwei (Jefferson Lab); KARPIE, Joseph; ORGINOS, Kostas (William and Mary - Jlab); SUFIAN, Raza; ZAFEIROPOULOS, Savvas (Aix Marseille Univ. & CNRS); MELNITCHOUK, Wally (Jefferson Lab); SATO, nobuo (jlab)

Presenter: BARRY, Patrick

Session Classification: Session II

Contribution ID: **23**   Type: **not specified**

QCD factorization for twist-3 quasi and pseudo-distributions

Thursday, 9 December 2021 11:40 (25 minutes)

In this talk, I will discuss our recent studies of the twist-3 nucleon parton distribution functions suitable for lattice simulations. The corresponding factorized expressions are derived in terms of the twist-two and twist-three collinear distributions to one-loop accuracy. We present the one-loop matching coefficient functions both in position space, as the factorization theorem for Ioffe-time distributions, and in momentum space, for quasi- and pseudo-distributions.

Primary authors: BRAUN, Vladimir; JI, Yao; VLADIMIROV, Alexey (University of Regensburg)

Presenter: JI, Yao

Session Classification: Session II

Contribution ID: **24**   Type: **not specified**

Lattice Calculation of the Second Moment of the Pion Light-Cone Distribution Amplitude

Tuesday, 7 December 2021 11:15 (15 minutes)

The pion light-cone distribution amplitude (LCDA) carries information about the momentum distribution of its quarks, which is an important input to various experiments. We present a proof-of-concept lattice calculation of the second Mellin moment of the pion LCDA as the first numerical implementation of the heavy-quark operator product expansion (HOPE) method. The resulting value for the second Mellin moment, determined in quenched QCD at a pion mass of $m_\pi = 550$ MeV at a factorization scale of 2 GeV, is $\langle \xi^2 \rangle = 0.210 \pm 0.013$ (stat.) ± 0.034 (sys.). This result is compatible with those from previous determinations of this quantity.

Primary authors: GREBE, Anthony; LIN, David (National Yang Ming Chiao Tung University); KANAMORI, Issaku (R-CCS, RIKEN); PERRY, Robert; MONDAL, Santanu (Los Alamos National Laboratory); DETMOLD, William (Massachusetts Institute of Technology); ZHAO, Yong (Brookhaven National Laboratory)

Presenter: GREBE, Anthony

Session Classification: Session II

Contribution ID: **25**   Type: **not specified**

Investigation of the fourth moment of the pion light-cone distribution amplitude

Tuesday, 7 December 2021 11:30 (15 minutes)

The light-cone distribution amplitude (LCDA) is a key object of interest in a range of high-energy, exclusive processes in QCD. In this talk, we describe the application of the heavy quark operator product expansion (HOPE) method to a preliminary study of the fourth Mellin moment of the pion LCDA. This constitutes the first study of the fourth moment from lattice QCD. We present an exploratory investigation at a pion mass of 560 MeV in the quenched approximation.

Primary authors: GREBE, Anthony (Massachusetts Institute of Technology); DETMOLD, William (Massachusetts Institute of Technology); LIN, C.-J. David (National Yang Ming Chiao Tung University); KANAMORI, Issaku (R-CCS, RIKEN); PERRY, Robert (National Yang Ming Chiao Tung University); MONDAL, Santanu (Los Alamos National Laboratory); ZHAO, Yong (Argonne National Laboratory)

Presenter: PERRY, Robert (National Yang Ming Chiao Tung University)

Session Classification: Session II

Contribution ID: **26** Type: **not specified**

Lattice QCD calculation of the Collins-Soper kernel from quasi TMDPDFs

Thursday, 9 December 2021 09:15 (25 minutes)

I will present a LQCD calculation of the nonperturbative Collins-Soper kernel, which describes the rapidity evolution of quark transverse-momentum-dependent parton distribution functions. The kernel is extracted at transverse momentum scales in the range 400 MeV < qT < 1.7 GeV in a calculation with dynamical fermions and quark masses corresponding to a larger-than-physical pion mass of 538 MeV. It is found that different approaches to extract the Collins-Soper kernel from the same underlying lattice QCD matrix elements yield significantly different results and uncertainty estimates, revealing that power corrections, such as those associated with higher-twist effects, and perturbative matching between quasi and light-cone beam functions, cannot be neglected.

Primary authors: WAGMAN, Michael; SHANAHAN, Phiala; ZHAO, Yong

Presenter: WAGMAN, Michael

Session Classification: Session I